

Remarks

Applicant and his attorney thank the Examiner for a telephone interview on June 21, 2006.

Background

Pending claims 1, 4, and 5 have been cancelled, and new claims 6-12 presented in this amendment. Claims have been redrafted with new terms. The term “continuous, uninterrupted” (with respect to barrier layers against sodium movement) refers to the covering, continuous and unbroken layers diagrammed in Fig. 1 and Fig. 2. The term “highly doped n-type amorphous silicon layer” is supported, for example, in the 3rd paragraph after TABLE 1 (describing “formed on an entire surface of the high dope n-type amorphous silicon layer”). The term “bulk phase crystalline semiconductor” is supported, for example in the third paragraph before TABLE 2 (“sodium ions are shielded by a thick bulk semiconductor”). The term “transparent to light” added to the claim 12 comes from claim 2 as originally filed. Accordingly, no new matter has been added.

The new claims recite elements of an inventive concept

This patent application teaches new insights and solutions to a solar cell degradation problem. In particular, the water entry problem that leads to degradation of efficiency is seen as a sodium mobilization problem. Because of water, hydroscopic sodium ions from a glass surface can move into and poison an active region, thereby lowering solar cell efficiency.

In the past, this problem has been alleviated by for example providing a metal foil at the rear, to limit water entry there. The inventive insight here, however, was to place the active pn junction that generates displaced charge carriers in response to light passing through the glass, away from the glass surface. Interposed between the junction and the glass is a “thick bulk semiconductor” (3 paragraphs before TABLE 2), which blocks sodium movement.

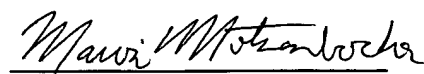
Such solution is not taught in the cited art and is implemented various ways. In one, a rear foil can be left off or replaced with a polymer such that “the rear surface member...is a transparent plastic film ...” (8th paragraph under “Preferred Embodiments of the Invention”) but with sodium barriers between the glass window and the active junction. As unexpectedly found (data of TABLE 1 and 2) using this technique, the water resistance performance with the water permissive polymeric rear coating together with the sodium barriers now claimed, equaled or exceeded that using the old approach of an opaque metal foil to limit the sodium problem. These barrier features, (continuous,

unbroken barriers, highly N doped, thick bulk) now are claimed more specifically in new claims 6-12. A further distinction from the cited art of Sakita Hitoshi (JP 11-307791) is recited in claim 11 as transparency of the rear film member. Hitoshi presents a rear surface that is not transparent but that reflects light from the other direction.

Applicant points out that lack of appreciation of the specific problem, much less the solution arrived at, evince lack of motivation for a skilled artisan to combine features. Furthermore, the unexpected results as presented in the two tables, is strong evidence of lack of obviousness and a lack of motivation to combine the cited elements. Still further, the relatively complicated addition of layers along with collector electrodes on both sides, engenders an otherwise undesirable complication with higher cost, that, without an understanding of benefit as taught in the specification, would lead a skilled artisan away from the final combination. An artisan is motivated to save money and not spend more money on a more complicated structure as claimed with extra layers for no good reason. An artisan has no motivation to make the slightly more complex structures as described and claimed, without benefit of applicant's explanation and unexpected results.

Consideration and allowance earnestly are solicited. If a telephone conversation can facilitate disposition of this case, the Examiner cordially is requested to contact the undersigned attorney at 202-204-4728.

Respectfully submitted,



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